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AREA: Síntese e caracterização de catalisadores e adsorventes.

Evaluation of barium removal by zeolite natural Clinoptilolite

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Resumo-Abstract

The contamination of water bodies by toxic metals has been one of the main problems faced today (1). Among the techniques capable of treating water bodies contaminated by these metals, natural adsorbents such as zeolites stand out due to their good ion exchange capacity and low cost (2,3). Depending on their origin, natural waters may also have different metallic ions in their composition, so it is important to consider the influence of these ions on the removal of heavy metals (4). Thus, the aims to investigate the interference of alkali metals (Ca^{2+}, Mg^{2+} and Na^{+}) in barium removal through adsorption tests with the natural clinoptilolite zeolite. The raw material used to carry out this work was the clinoptilolite zeolite granted by the Celta Brasil company. Initially, the material was ground in Retsch model PM 100 equipment and was separated by sieving on a 400 mesh sieve. Then, the material was characterized using X-ray diffraction with the aid of the Bruker model D2 Phaser analyzer. Subsequently, two solutions were prepared with chloride salts with analytical purity. Solution A was adjusted to have a concentration of 40 $mg.L^{-1}$ of barium and solution B was prepared containing 40 $mg.L^{-1}$ of barium, 500 $mg.L^{-1}$ of sodium, 1,000 $mg.L^{-1}$ of calcium and magnesium. After that, the pH of both solutions was adjusted between 2 and 3 with concentrated nitric acid. Adsorption tests involved batch system with 300 mg of zeolite in contact with 50 ml of solution A and B, under agitation of 150 rpm for 4 hours at room temperature. The concentration of metal in solutions was evaluated through the ICP-OES ICAP 6300 duo. The X-ray diffractions presented a characteristic clinoptilolite pattern, which has intense reflections in 9.83, 22.33 and 25.74 at 2θ degrees. The outcome of the adsorption test in a solution A (barium cations) showed high efficiency regarding the barium removal, approximately 98.2%. However by performing the test in a solution B (Ca^{2+}, Mg^{2+} and Na^{+} cations) under the same conditions, the effectiveness of barium removal fell to 61.3%. This behavior is due to the competitiveness of ions by occupying the active sites of the zeolite and this process depends on several factors such as: zeolite selectivity, hydration energy, ionic radius and concentration of the species involved (4.6). Therefore, it is evident that clinoptilolite zeolite was able to barium removal and although its effectiveness is affected by the presence of other metal ions, the values show their potential as an adsorbent and/or ion exchanger for treatment of industrial effluents.

Keywords: water contamination, toxic metals, treatment, adsorption.

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